Taxable Income Responses to 1990s Tax Acts: Further Explorations

Seth Giertz

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Seth H. Giertz
Tax Analysis Division
Congressional Budget Office
Washington, D.C.

Seth.Giertz@cbo.gov

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The Elasticity of Taxable Income during the 1990s: Further Explorations

Abstract

This paper presents applications of variants of a differencing methodology to Internal Revenue Service tax records in order to estimate taxable income elasticities for the 1990s. Estimates are systematically examined by applying a number of sensitivity tests. Estimates are produced after altering the: (1) time interval over which observational-level behavior is measured; (2) income restrictions on the sample; (3) choice of control variables; and (4) weighting scheme used in the regressions. In general, estimates are quite sensitive to a number of different factors. In contrast to some of the literature, estimates are larger when behavior is measured over 3-year intervals as opposed to over 1-year intervals, suggesting small transitory responses to tax changes but larger longer-term responses. When including the richest set of income controls, income-weighted short-term elasticity estimates (based on 1-year differencing) range from 0 to 0.19. Similarly estimated longer-term elasticities (where data are differenced over 3-year intervals) are about 0.32. When adding adjacent year tax rates to the model, short-term elasticity estimates range from 0.30 to 0.43 and longer-term estimates from 0.97 to 1.37. In most cases, estimates from an end-year approach (which includes only 2 years of data, one well before the tax change and one well after) are not statistically different from 0. However, even for the approaches that produce statistically significant results, estimates are sensitive to an array of factors and plausible sensitivity checks often result in estimates that differ greatly. A major conclusion is that isolating the true taxable income responses to tax changes is inherently complex and little confidence should be placed on any single estimate.

JEL Codes: H2, H21, H31, and J22

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I. Introduction

This paper is the third in a series describing estimates of the elasticity of taxable income with a focus on the sensitivity of these estimates to an array of factors (see Giertz 2006 and 2008). The paper revisits the 1990s tax increases using panels constructed from Internal Revenue Service tax return data for 1988–95 from the Statistics of Income (SOI). These data heavily oversample high-income filers, who, research suggests, play a critical role in determining overall responses to changes in tax rates (Navratil 1995; Moffitt and Wilhelm 2000; Gruber and Saez 2002; and Saez 2004).

This paper makes several contributions to the recent literature. It offers estimates of new elasticities for the 1990s. These estimates are systematically examined by applying a wide array of sensitivity tests. The estimates are produced using different regression weights (i.e., unweighted versus income-weighted) and alternative sample income restrictions. Furthermore, in order to examine the effect of income controls on estimates, six different specifications are run using different intervals (1-, 3-, and 6-year differences) for the measurement of (observation-level) behavior.

In general, income-weighted estimates are larger when behavior is measured over 3-year rather than 1-year intervals. This is in contrast to some of the literature, which has found large transitory responses to tax changes but smaller longer-term responses. With the richest set of income controls, but with no allowance for adjacent-year income shifting, income-weighted ETI estimates based on 1-year differencing range from 0 to 0.19. Similarly estimated elasticities over 3-year intervals are about 0.32 (and not sensitive to income cutoffs). The inclusion of adjacent-year tax rates (to control for income shifting between years adjacent to each base and subsequent year) results in much larger estimates, ranging from 0.30 to 0.43 for 1-year differences and from

0.97 to 1.37 for 3-year differences. However, among the four specifications that include separate controls for mean reversion and income divergence, estimates range from 0.41 to 1.37. And using the specification preferred by Gruber and Saez yields an estimated elasticity of 0.3 (compared to their estimate of 0.4 for the 1980s). In most cases, estimates from the end-year approach are not statistically different from 0 for the 1990s, in contrast to estimates for the 1980s, where the same approach yields estimates ranging from 0.39 to 0.67.

While this paper provides insight into what methods may be more effective in accurately identifying responses to changes in tax rates, the findings more broadly highlight the inherent complexities in separating these responses from the myriad of other factors that influence income. Incorporating more sophisticated controls for mean reversion and income divergence may improve estimates, but reasonable a priori specification decisions can lead to a wide array of estimates and thus little confidence should be placed on any single estimate.

II. The Omnibus Budget and Reconciliation Acts of 1990 and 1993

The two major tax changes examined in this paper are the Omnibus Budget and Reconciliation Acts (OBRA) of 1990 and 1993. Both tax changes generally raised income tax rates on higher income filers and left them unchanged for those in the lower brackets.

OBRA 90 raised both the marginal tax rate on top incomes (from 28 to 31 percent) and the cap on wages subject to Social Security’s hospital insurance tax, which funds Medicare and amounts to 2.9 percent when including both the employee and employer share (from $53,400 to $125,000). Although OBRA 90 represented a major tax increase, it lowered marginal tax rates for filers in the so-called “bubble bracket” (prior to OBRA 90), who generally saw their marginal income tax rate decline from 33 to 31 percent.[1]

OBRA 93 created two new high-income tax brackets, at rates of 36 and 39.6 percent, and lifted the cap on wages and salaries subject to the Social Security hospital insurance cap. The new tax brackets were retroactive and applied for 1993; the removal of the hospital insurance cap took effect in 1994. The bill’s key provisions did not directly affect those in the lower tax brackets.

III. Data and Methods

Data on individual tax returns for 1984, 1985, and 1988–95 are from the Statistics of Income (SOI), a large sample of tax returns compiled by the Internal Revenue Service that includes all information reported on filers’ tax returns as well as additional demographic information.

Constructing Three Samples

The analysis relies on three samples constructed from the SOI so as to conform to the three key methodological variants. The main distinction between these variants is the time interval over which individual-level behavior is examined (i.e., over 1-, 3-, or 6-year intervals). The approach is presented in detail later in this section.

Table 1 presents summary statistics for the three samples, which include only filers with taxable income greater than $10,000 whose filing status did not change over the sample period. The sample for the year-to-year analysis comprises 99,421 paired observations (14,203 filers) and spans years 1989 to 1995. Mean taxable income (in 1992 dollars and adjusted by sampling

[1] Before OBRA 90, those with incomes beyond the 33 percent bracket faced marginal tax rates of 28 percent. These filers were moved to the 31 percent bracket after OBRA 90.

weights) is $36,656 and mean gross income is $51,827. The sample is restricted to filers present in every year from 1989 to 1995,[2] but this restriction should not be particularly important as observations in the regression analysis are weighted by the inverse of their probability of appearing in the sample.

The other two samples are very similar to each other in their construction. The sample used to measure responses over 3-year intervals includes base years (i.e., the first year of each observation) 1989 to 1992, paired with subsequent years 1992 to 1995 (i.e., the second year of each paired observation). The sample comparing end years examines responses between just 1989 and 1995. Both require that the filer be present only in the base and subsequent year, not every year from 1989 to 1995. The sample used to measure responses over 3-year intervals comprises 157,083 paired observations. Mean taxable income is $34,877 and gross income $55,749 (in 1992 dollars and adjusted by sampling weights). The sample for examining behavior between end years has 31,142 paired observations, with a mean taxable income of $41,360 and gross income of $60,047 (in 1992 dollars and adjusted by sampling weights). For comparison, data for 37,673 filers[3] in 1985–89 are used to estimate elasticities of taxable income (ETIs) for the Tax Reform Act of 1986 (TRA 86).

Econometric Approach

The methodology focuses on individual-level changes in income (i.e., first differences) measured over 1-, 3-, and 6-year intervals. The following equation is estimated via two-stage least squares:

[2] Filers in each sample must also be present in 1988 because data from this year are used in constructing the independent variables.
[3] Auten and Carroll (1999 also employ a variation of this approach using similar data for 1985 and 1989. Their control variables and income restrictions are not the same, however.

$$\ln\left(\frac{income_{t^s}}{income_t}\right) = \alpha + \xi \cdot \ln\left(\frac{1-\tau_{t^s}}{1-\tau_t}\right) + year \cdot \beta_1 + f(income_t, income_{t-1}) \cdot \beta_2 + X \cdot \gamma + \varepsilon \cdot \tag{1}$$ [4]

The dependent variable is the log of income in a subsequent year $(income_{t^s})$ divided by income in the base year ($income_t$), where the subsequent year is 1, 3, or 6 years after the base. The key independent variable equals the log of the net-of-tax rate (NTR) in the same subsequent year $(1-\tau_{t^s})$ divided by the NTR in the base year $(1 - \tau_t)$.[5] To avoid endogeneity between the tax rate and income, an instrument is included for the actual log change in the NTR. The coefficient on that variable, ξ, represents the ETI. In addition the analyses include year fixed-effects plus demographic information (X), including age, gender, and marital and itemization status. Functions of income in the base year and the year prior ($f(income_t, income_{t-1})$) are included in order to control for two of the most vexing obstacles to identification, mean reversion and non-tax-related divergence in the income distribution.

Finally, in examinations of year-to-year responses, the explanatory variables include both a 1-year lag and a 1-year lead in the log change in the NTR, in addition to the log change itself. The lag is intended to account for income shifting resulting from a change in tax rates in the previous year; such shifting could affect base-year income and, if not accounted for, could bias elasticities estimates associated with the change in the NTR from the base to subsequent year.[6] Analogously, the lead is intended to account for income shifting between the later year of each paired observation and the year after (recall that in the 1990s, marginal tax rates increased for some taxpayers in both 1993 and 1994).

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[4] For simplicity, the equation omits subscripts denoting the individual.
[5] In addition, Gruber and Saez (2002) include a variable to separate the income effect from the substitution effect. They conclude that the income effect is not important and thus exclude it from most of their analysis.
[6] This issue should not be a problem with the end-year approach because the two years chosen are either well before or well after the tax changes. It could however be an issue when examining 3-year differences.

The lag is potentially important if the NTR falls from the year prior to the base, as individuals may shift income from the base year to the preceding year, making base-year income smaller than otherwise. If rates also change from the base to the subsequent year, this shifting could overstate the tax response.[7]

Likewise, the leading rate is potentially important if the NTR falls between the year subsequent to the base and the following year, inducing individuals to shift income from the year following the subsequent year to the subsequent year, making income in the subsequent year larger than otherwise. Additionally, if rates do not change between the base and subsequent year, exclusion of the leading and lagged rate changes could bias the counterfactual income trend, which could in turn bias ETI estimates.

Two different income measures are examined. The first measure is gross income, where

> gross income = total income – adjustments[8] – capital gains – supplemental (Schedule E) income or loss + dividends excluded from AGI + unemployment compensation not included in AGI + Keogh and traditional IRA contributions + forfeited interest penalties + alimony paid.

The second income measure is taxable income, which equals gross income less exemptions and the greater of the standard or itemized deductions. As with most of the studies in this literature, capital gains are excluded from the analysis because they are observed only when they are realized, not when they accrue. Social Security benefits are excluded because they are not fully observed in all years.

[7] Here and in the following paragraph income shifting is discussed with respect to a falling NTR. The analysis is the same for an increasing NTR, except that income would be moving (i.e., shifting) in the opposite direction.

[8] Adjustments (e.g., certain education expenses, student loan interest, and contributions to traditional IRAs) are subtracted from total income to calculate AGI.

Income measures are defined according to 1990 law and adjusted by growth in gross income, with 1992 as the point of reference.[9] Over time, both tax rates and the definition of taxable income itself change—for example, deductions and exemptions permitted in some years are not allowed in others; the definition of income can affect responses to changes in tax rates (Slemrod and Kopczuk 2002). Additionally, Heim (2007) shows that changes to allowable exclusions and deductions can bias estimates, even when using a constant law definition of taxable income, unless the cross-price elasticities between activities whose tax status has changed and those for which it has not are zero or are known and taken into account.

The interval over which behavior is measured could have implications for the size of responses. The year-to-year analysis is likely to capture transitory behavior, in addition to the beginnings of a longer-term shift in behavior. Some analysts have found very large short-term responses.[10] Examining behavior over 3-year intervals is intended to capture longer-term (or permanent) responses. In practice, however, shifting as a result of tax rate changes in years adjacent to the years used in differencing could bias this estimate. The end-year approach is intended to focus exclusively on permanent responses, avoiding potential biases resulting from shifting between years adjacent to the two years used in creating each paired observation. That is, the years used for the end-year analysis are chosen so that they are more than a year prior to the tax change takes effect and more than a year after it is fully phased in. However, the use of end years excludes some potentially valuable sources of variation. For example, data on income changes for other pairs of years (in which tax rates did not change) may be helpful in

[9] The adjustment for gross-income growth is analogous to adjustments that transform nominal dollars into real dollars. Thus, for this paper, each individual's reported income is multiplied by the ratio of average gross income in 1990 over the average gross income in the year of the observation.

[10] With respect to the 1990s, see Sammartino and Weiner (1997) and Goolsbee (2000).

constructing counterfactual income trends (i.e., absent a tax change), which is necessary for identifying the true tax response.

The alternative controls[11] for mean reversion and heterogeneous income trends across the income distribution are a major focus of the following discussion. In addition to a specification with no income controls, six alternatives are explored where $f(income_t, income_{t-1})$ in equation (1) represents the different control variables shown in Table 2. Existing evidence supports both the presence of both heterogeneous income trends and mean reversion. It also suggests that these phenomena are large and, if not accounted for, could overwhelm tax responses.

Alternatives *A* and *B* include controls for either (*A*) income in the base year or (*B*) income in the year before the base and the change in income from the year preceding the base. Alternative *B* has the advantage over *A* because it includes *separate* controls for mean reversion and for divergence in the income distribution. However, both alternatives are likely insufficient because they allow only for a linear relationship between nontax factors and income growth. The Congressional Budget Office (2001), Piketty and Saez (2003), and others show heterogeneous rates of income growth across the income distribution during the past few decades (including the 1990s). Growth rates are much greater (and more volatile) at the very top of the income distribution and do not increase linearly with income. This peculiarity in the evolution of the income distribution has greatly reduced the efficacy of some otherwise sound econometric techniques (such as differences-in-differences). Diverging income trends suggest that income growth for a group not experiencing a tax change may be a poor counterfactual for another group that is experiencing a tax change. And the jaggedness of these diverging trends suggests that an

[11] Alternatives *A* and *C* are the same as those used by Gruber and Saez (2002); Kopczuk (2005) used alternatives *B* and *D* through *F*. Both studies focused on the 1980s.

assumption that a group facing a tax change would have experienced income growth similar to what they experienced in years when taxes did not change may also be specious.

In the 1990s, when the NTR was generally falling, imposing a linear control for income growth due to nontax factors (i.e., a nonlinear phenomena) would likely attribute too little of the income growth at the top of the distribution to nontax factors. Because those at the top of the distribution are a driving force behind the overall response, linear controls, by overestimating the counterfactual income trend at the top, likely underestimate the effect of rising marginal tax rates on taxable income.

Alternatives *C* through *F* will likely do a better job because they include at least one nonlinear component (i.e., a 10-piece spline) that allows for non-tax-related income changes that vary by income decile. Alternative *F* has the greatest likelihood of adequately controlling for the nontax effects because it includes separate and nonlinear controls for both mean reversion and divergence in the income distribution. It is unlikely that just one variable could adequately account for these two phenomena (see Kopczuk 2005).

The richest specification (alternative *F*) for the year-to-year approach can be written such that

$$\begin{aligned}\ln\left(\frac{income_{t+1}}{income_t}\right) &= \alpha + \xi_0 \ln\left(\frac{1-\tau_{t+1}}{1-\tau_t}\right) + \xi_1 \ln\left(\frac{1-\tau_t}{1-\tau_{t-1}}\right) + \xi_2 \ln\left(\frac{1-\tau_{t+2}}{1-\tau_{t+1}}\right) + year\beta_1 \\ &+ \beta_2 \text{spline}(\ln(income_{t-1})) + \beta_3 \text{spline}\left(\ln\left(\frac{income_t}{income_{t-1}}\right)\right) + X\gamma + \varepsilon,\end{aligned} \tag{2}$$

where ξ_1 and ξ_2 represent the coefficients for the lagged and lead changes in the NTR, respectively. For analyses of behavior over the other two intervals, the lead and lag coefficients are excluded and the full specification can be written such that

$$\ln\left(\frac{income_{t^s}}{income_t}\right) = \alpha + \xi \ln\left(\frac{1-\tau_{t^s}}{1-\tau_t}\right) + year\beta_1 + \beta_2 \text{spline}\left(\ln(income_{t-1})\right)$$
$$+ \beta_3 \text{spline}\left(\ln\left(\frac{income_t}{income_{t-1}}\right)\right) + X\gamma + \varepsilon. \qquad (3)$$

For the end-year approach, lead and lagged rate changes are likely unimportant because the two years are chosen such that rates generally are not changing in adjacent years. But for examinations of behavior over 3-year intervals, the lead and lagged tax rates could be important for both the base year and the subsequent year. However, including these covariates would require a new sample that included only filers that appear in all of these adjacent years.

In addition to these controls, each specification is estimated after imposing income floors of $10,000, $30,000, and $50,000 on the base year of each paired observation (imposing the floor on both the base and subsequent year could introduce bias, since some near the threshold would be included in the sample if their income rose but excluded if it fell). The restrictions are imposed to test whether the other variables adequately control for mean reversion at the bottom of the income distribution. Because the tax changes target upper-income filers, these floors are unlikely to exclude those experiencing a federal tax change, but they will alter the sample of filers used to identify counterfactual behavior (absent a tax change).[12] Mean reversion is especially pronounced at the tails of the distribution. People at the high end of the income distribution are often not there for extended periods and will probably have a substantial drop in income that is unrelated to tax policy. At the other extreme, students often have a large increase in income when they enter the workforce. Estimating the ETI without fully controlling for mean reversion will result in a spurious correlation between non-tax-related increases (by people below

[12] The income cutoffs are based on gross income in 1992 dollars. The $10,000 cutoff is similar to the restriction imposed by Gruber and Saez (2002), the $30,000 cutoff is similar to that used by Auten and Carroll (1999), and the $50,000 cutoff is similar to that used by Carroll (1998).

their lifetime path) and decreases (by those above their lifetime path) in taxable income as responses to changes in tax rates.

Tax Rate Imputations and Instruments

Individual marginal tax rates are imputed using the CBO's internal tax calculators. Only federal rates are imputed for the year-to-year sample; for the other two samples, both federal and state rates are imputed.[13] For the year-to-year sample, an instrument for the NTR is created by applying the tax schedule in each year to average income for years 1989 to 1995. For the other two samples, the tax rate instrument is constructed by inflating base-year income by the growth in mean gross income over the (either 3- or 6-year) interval between the base and subsequent year. Next, the tax calculator computes counterfactual tax rates based on the inflated income measure.

For the year-to-year sample, the mean federal marginal tax rate is 24.1 percent, for the sample focused on 3-year intervals the rate is 23.6 percent, and when including state rates the mean is 28 percent. For the end-year sample, the corresponding rates are 24.6 percent for federal taxes and 29.1 percent overall.

Income Weighting

Income weighting places much more emphasis on responses at the top of the income distribution and is designed to yield results that are indicative of the overall income response (and tax revenue implications) resulting from a change in tax rates. If responses do not vary by income, then weighting will not affect ETI estimates. However, research consistently finds that estimated

[13] For information on CBO's state tax calculator, see Bakija (2006).

ETIs rise with income[14]; thus a single overall elasticity is not applicable when considering the impact of rate changes that target only part of the income distribution or for rate changes that differ across the distribution. In addition, a meaningful average overall ETI must take into account the correlation between income and elasticities.

Sample Weighting

While some of the regressions are weighted by income, all are weighted to adjust for the SOI's nonrandom sampling properties. Selection into the SOI is conditional on several factors, including income. Sampling probabilities reach 100 percent for very high income filers. In addition, filers sampled once are sampled in all subsequent years if their income increases (and other characteristics, such as filing status, do not change). In fact, the probability that a filer is observed in two different years is simply the minimum of the sampling probabilities for the two years. Without weighting, the sampling strategy raises the potential for spurious correlation between the dependent variable $(\ln(income_{t_s}/income_t))$ and the independent variables, including the tax variable. To avoid that possibility, (paired) observations from the full SOI are weighted by the reciprocal of their probability of appearing in the sample. That strategy is discussed in Auten and Carroll (1999), who also employ the strategy using SOI data.[15]

IV. Results

[14] People with higher incomes generally have more opportunities to respond to tax changes (see Saez 2004). They generally itemize their tax returns, rely less on wage and salary income, and have more control over the timing and sources of their income than do other groups. People with more modest incomes can change their labor supply or alter the degree to which they use certain deductions and exemptions, but likely have relatively few alternatives to alter their taxable income.

[15] Income-weighted results are produced by simply multiplying income by the weights used to adjust for the SOI's nonrandom properties.

Table 3 presents income-weighted ETI estimates and standard errors for each of the specifications without allowing for income shifting between years adjacent to the years used to construct each paired observation. Using the richest set of income controls (i.e., specification *F*, which includes two 10-piece splines) and imposing a $50,000 income cutoff yields income-weighted estimated ETIs ranging from 0.33 (measuring responses over 3-year intervals) to 0.19 (measuring year-to-year responses). The corresponding estimate for the end-year approach is 0.34, although that estimate is not statistically different from 0. A comparison of estimates over 1- and 3-year intervals suggests that the longer-term responses to the 1990s tax increases were substantially larger than transitory responses.[16] Additionally and for comparison, Panel 4 of Table 3 presents estimates using years 1985 and 1989, the same years used by Auten and Carroll (1999).

Table 4 is constructed in the same manner as Table 3, but estimates are based on specifications that included adjacent-year rate changes. Tables 5 and 6 are analogous to Tables 3 and 4, except that the dependent variable is based on differences in gross income rather than taxable income. Those tables present only estimated coefficients (i.e., elasticities) and standard errors for the key dependent variable.

Results from Year-to-Year Differencing

Income-weighted estimates are smaller when using year-to-year differences as opposed to the other intervals examined. Panel 1 of Table 3 reports estimates for 1-year differencing. With the richest set of controls (specification *F*), the estimated ETIs increase with the income cutoff from 0 to 0.19 (also see Table 4). (Although not shown, raising the income cutoff to $75,000 also

[16] This finding contrasts with the findings of Sammartino and Weiner (1997) and Goolsbee (2000) who, also for the

leaves the estimated ETI at about 0.2.) With the \$50,000 income cutoff, the estimated ETI is −0.18 when employing the Gruber and Saez preferred set of controls. However, the four specifications that include separate controls for mean reversion and divergence in the income distribution all yield estimated ETIs of about 0.19.

Table 4 presents estimates for differencing based on 1- and 3-year intervals and, in addition to the log change in the NTR, with a 1-year lag and 1-year lead in this log change. The estimated coefficients on the lagged rate change (when including the richest set of income controls) range from 0.30 to 0.43. By comparison, including the lagged and lead rates with the controls favored by Gruber and Saez (i.e., specification *C*) results in estimated ETIs that are modestly negative and not statistically different from 0. Note that the estimated coefficients on the lagged and lead change in tax rates are not part of the elasticity estimate because they are not part of the concurrent change in tax rates. These variables are included solely because these factors could influence base- or subsequent-year income, and in turn the dependent variable. Because the years for the lagged and leading tax changes are not endogenous, they are included without instruments. Income shifting due to the actual lagged and lead changes in tax rates should be taken into account, even if the change in the lagged or lead rate is due to changes in behavior and not to a change in statute. In addition to their effect on the estimated ETIs, the estimates on the lagged and lead NTR coefficients (sometimes in excess of 1) suggest that these variables are important. Note that, if the lag and lead were instrumented to contain only variation resulting from changes in statute, the estimated coefficients should be negative (or zero), since a higher NTR in an adjacent period should induce filers to shift income from the current period to the adjacent. However, without instruments, the predicted sign on these coefficients is ambiguous,

1990s tax changes, find evidence of large transitory shifting.

since in response to a legislated drop in the NTR a filer could work less, falling into a lower actual tax bracket.

With a $50,000 income cutoff, estimates from the four specifications that include separate controls for mean reversion (specifications *B*, *D*, *E*, and *F* from Table 4 Panel 1) are very similar, ranging from 0.38 to 0.44. These estimates, when including both sets of income controls, are within the 0.38–0.56 range reported by Carroll (1998) (also using year-to-year differences for the same time period). However, Carroll does not weight estimates by income or control for adjacent-year rate changes, and his estimates are larger than my person-weighted estimates (see Appendix Table A1).[17]

Turning to gross income, estimated elasticities are smaller with the richest set of controls, ranging from 0.14 to 0.17, depending on the income cutoff and the use (or not) of adjacent-year controls (see Tables 5 and 6). Without the adjacent-year controls, estimates are small and not statistically different from 0. The fact that the estimates are smaller than the corresponding estimates for taxable income likely reflects the fact that gross income is a broader measure and thus there are fewer opportunities to shift income outside this base. Additionally, the denominator for the gross income elasticity is larger. Thus, for an equivalent income response, the elasticity will be smaller for gross income than for taxable income. In examinations of behavior over 1-year intervals, Heim (2007) and Carroll (1998) also find somewhat smaller estimated elasticities when looking at broader income measures.

Results from Differencing by 3-Year Intervals

[17] Carroll (1998) does not include any nonlinear income controls, but does include industry and occupation dummies.

With the richest set of income controls, estimated ETIs resulting from 3-year differencing are about 0.33 and the income cutoff has virtually no effect on the estimate (see Table 3 Panel 2, specification *F*). For most of the other specifications, ETI estimates rise with the income cutoff. Including a spline of the log of income in (t – 1) and the difference in the logs of base-year income and the income in (t – 1) yields similar results, with ETI estimates ranging from 0.34 to 0.38. For the other specifications, estimates are much more sensitive to income cutoffs. Gruber and Saez's preferred specification (*C*) yields estimates from 0.30 with a $10,000 income cutoff to 0.54 with a $50,000 income cutoff.

My estimates, when including both sets of nonlinear income controls, are larger than corresponding estimates, ranging from 0.19 to 0.26 (Giertz 2007), and smaller than the estimates of 0.53 to 0.58 reported by Heim (2007).[18] Those other estimates are also weighted by income, based on 1990s tax data and on responses over 3-year intervals.[19]

As with his year-to-year analysis, Heim's primary nonlinear income control is based on average income. When subject to the same income controls used in this analysis (i.e., 10-piece splines of both lagged income and the difference between base-year and lagged income), Heim's estimated ETIs are negative and not statistically significant. And after dropping years 1987 and 1988, his estimated ETIs of 0.53 and 0.58 jump to 1.37 and 1.58, respectively.

Table 4 Panel 2 presents estimates based on 3-year differences that, in addition to the log change in the NTR, include a 1-year lag and 1-year lead in this log change. When including the

[18]Heim's estimates, when examining behavior over 3-year intervals, are slightly larger than his corresponding estimates when using a year-to-year analysis. By contrast, this paper reports substantially larger responses with a year-to-year analysis (as opposed to analyzing behavior over 3-year intervals).

[19] Similar analyses in Gruber and Saez (2002), Kopczuk (2005), and Giertz (2007) suggest an overall income-weighted ETI of around 0.40 for the 1980s, but these estimates are often quite sensitive to a number of factors. When taking into account the broadening of the tax base in the 1980s, Kopczuk reports an estimated ETI of about 0.30. And in Giertz (2007), when including both sets of nonlinear income controls, I reported an income-weighted estimated ETI of 0.35 for the 1980s and 1990s combined.

adjacent-year controls, the estimated elasticities (with the richest set of income controls) are now much larger, ranging from 1.37 to 0.98—and falling with the income cutoff. For the other three specifications that include separate controls for mean reversion and divergence in the income distribution (i.e., specifications *B, D*, and *E*), estimated ETIs range from 0.41 to 1.42. By comparison, including the lagged and lead rates with the controls favored by Gruber and Saez (specification *C*) results in estimated ETIs that increase with the income cutoff from 0.47 to 0.73. Heim's ETI estimates, when controlling for changes in tax rates in years adjacent to each base year, are even larger than mine, ranging from 1.35 to 1.47.

Elasticities estimated with no income controls are substantially larger than those estimated using both sets of nonlinear controls (see the first column of estimates in Table 3 Panel 2). The much larger estimates without income controls suggest that mean reversion at the top of the income distribution dominates the secular increase in income, also at the top.[20] In a period such as the early 1990s, falling incomes (due to mean reversion) at the top of the income distribution are directly but spuriously correlated with an also falling NTR. Without income controls, at least a portion of that spurious correlation will be reflected in the estimated ETI. By contrast, in a period when the NTR is rising, such as the 1980s, that spurious correlation should bias estimates downward because the falling incomes at the top are inversely correlated with the rise in the NTR. In fact, this is exactly what I report when comparing estimates (over 3-year intervals) for the 1980s with those for the 1990s (Giertz 2007).

Turning to gross income, estimated elasticities are, in contrast to the analysis based on year-to-year differences, larger than corresponding estimates for taxable income (see Table 5 Panel 2). Gross income elasticities, when including both sets of nonlinear income controls, rise with the income cutoff from 0.19 to 0.30. By comparison, Heim's preferred estimate, using a broader measure of income (and examining responses over 3-year intervals), is about 0.46, whereas my preferred estimate for the 1990s is 0.13 (Giertz 2007). Again, when including adjacent year controls, gross income elasticities are much larger.

Results from Comparing End Years

Aside from the robustness of the estimates, do the estimates capture longer-term behavioral responses, as opposed to shorter-term income shifting? As noted earlier, comparing adjacent years may yield estimates that reflect transitory responses more than they do fundamental shifts in behavior, and these two can be very different. For example, Goolsbee (2000), examining the behavior of high-paid executives, finds very large transitory responses to the Omnibus Budget Reconciliation Act of 1993 (OBRA 1993) but only modest longer-term responses. One way to focus exclusively on longer-term responses is to compare behavior a couple of years before a tax change to behavior a couple of years afterward. Auten and Carroll (1999) used that approach to examine responses to the Tax Reform Act of 1986.

When employing the richest set of controls, the end-year approach, which includes years 1989 and 1995, yields estimated ETIs ranging from 0.34 to 0.47, depending on the income cutoff (see Table 3 Panel 3, specification *F*). However, estimates from this approach are rarely statistically different from 0. (With a $50,000 income cutoff, specification *C*, preferred by Gruber and Saez, yields a statistically insignificant ETI estimate of 0.47.) It appears that with just one set of paired observations, the absence of paired observations for higher income filers over a similar period when their tax rates did not change may greatly diminish the model's ability to

[20] Note that very few middle-income filers will move to the very top of the income distribution. But incomes for

identify counterfactual income trends. Furthermore, the inclusion of nonlinear functions of income, which are necessary to account for widening inequality at the top of the income distribution, makes identification all the more difficult since the instrumented tax rate is also a nonlinear function of income.[21]

For comparison, the end-year analysis is repeated for TRA 86, using years 1985 and 1989. In contrast to the estimates for the early 1990s, the 1980s estimates are often statistically significant. With the most comprehensive set of income controls (specification *F*), income-weighted estimates range from 0.39, with a $10,000 income cutoff, to 0.67, with a $50,000 income cutoff (see Table 3 Panel 4). (The other three specifications that include at least one nonlinear income control yield estimates ranging from 0.41 to 0.97, depending on the income cutoff.) It is not clear why estimated coefficients for the 1980s show strong statistical significance whereas the 1990s estimates do not. One possibility is that TRA 86 changed tax rates for a much larger share of the sample and by differing amounts, thus there is more cross-sectional variation in rates for the TRA 86 analysis than for the 1990s.

Income Cutoffs

Because the 1990 and 1993 tax increases targeted upper-income filers, many filers experienced no statutory change in federal tax rates over period. Lower-income filers serve to identify the non-tax-related income trend, but only to the extent that these trends are similar across income groups. Income growth during the period was slower for low-income groups than for higher-income groups. Thus, as the income cutoff for inclusion in the sample increases, the estimated counterfactual income trend (i.e., the trend absent any changes in tax law) may rise. If that

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most of those at the very top of the distribution will eventually fall to more moderate levels (independent of taxes).

phenomenon dominates, then raising the income cutoff over a period when tax rates were rising (i.e., when the NTR was falling), as in the first half of the 1990s, would increase elasticity estimates (as Carroll found when moving from a $50,000 to $75,000 cutoff). On the other hand, mean reversion may also be strong for lower-income filers. For the 1990s, the impact of mean reversion at the bottom of the distribution would have the opposite effect on estimated ETIs, lowering the estimates.

The analysis presented in this paper shows that, when not controlling for adjacent-year tax rate changes, estimates for the year-to-year approach are not particularly sensitive to the income cutoff. When comparing behavior over 3-year intervals, it appears that mean reversion at the bottom of the distribution tends to bias estimates downward. That is, when differencing over 3-year intervals, many of the specifications produce larger ETI estimates as the income cutoff is raised. This is also true of the end-year approach; however, estimates from that approach are generally not statistically significant. When adding adjacent-year income controls, the pattern is different: 1-year differencing results in ETI estimates that generally increase with the income cutoff, while 3-year differencing yields estimated ETIs that often fall as the income cutoff is raised.

V. Conclusion

This paper presents the results of variations of a differencing methodology applied to panels of Internal Revenue Service tax return data for the 1990s in order to estimate the responsiveness of taxable (and gross) income to changes in tax rates. In addition to varying the time interval over which behavior is measured, sensitivity tests explored different combinations of control variables as well as alternative weighting strategies and sample selection criteria. While many of the

[21] Gross income elasticities too are not statistically different from 0 using the end-year approach.

estimates are in line with the wide range found in the recent literature, they are often quite sensitive to factors such as specification, time period analyzed, and sample income cutoffs.

In general, income-weighted estimates are larger when behavior is measured over 3-year intervals as opposed to 1-year intervals. This is in contrast to some reports of large transitory responses to tax changes but smaller longer-term responses. When including the richest set of income controls, but not allowing for adjacent-year income shifting, income-weighted ETI estimates based on 1-year differencing range from 0 to 0.19. Similarly estimated elasticities over 3-year intervals are about 0.32 (and not sensitive to income cutoffs). The inclusion of adjacent-year tax rates to control for income shifting between years adjacent to each base and subsequent year results in much larger estimates. Estimates based on 1-year differencing now range from 0.30 to 0.43, and those for 3-year intervals range from 0.97 to 1.37. However, among the four specifications that include separate controls for mean reversion and income divergence, estimates range from 0.41 to 1.37. Estimates from the end-year approach vary in magnitude, but are generally not statistically different from 0, suggesting that, at least for this period, there is not enough variation to identify responses with just 2 years of data.

The findings in this paper show that, for the 1990s, the use of separate controls for income divergence and mean reversion tends to yield more robust estimates. Additionally, when including the richest set of income controls, estimated ETIs for the 1990s are similar to recent estimates for the 1980s, although generally much smaller than reported in some of the earlier studies that examined that period. Other specifications (most of which exclude either separate controls for mean reversion and divergence in the income distribution or a nonlinear income control) often yield very different results and are usually much more sensitive to income cutoffs. The inclusion of a 10-piece spline of logged base-year income as the sole income control, for example, yields estimated ETIs that are substantially negative when measuring behavior over 1-year intervals.

While more sophisticated control variables sometimes yield more robust estimates, estimates are still sensitive to reasonable a priori specification decisions. This reflects the inherent complexity of separating responses to changes in tax rates from the many other factors that also influence income. Divergence in the income distribution remains one of the most intransigent obstacles to correctly identifying the ETI. The fact that the divergence in incomes has persisted through periods of both increases and decreases in the level and progressivity of tax rates suggests that it is, in large part, not a direct response to tax changes. However, the possibility that the phenomenon results from a longer-run and more nuanced response to the lowering of marginal tax rates on top income since World War II cannot be ruled out.[22]

References

Auten, Gerald and Robert Carroll, "The Effect of Income Taxes on Household Behavior," *Review of Economics and Statistics*, November 1999, 81 (4), 681-693.

Bakija, Jon, "Documentation for a Comprehensive Historical U.S. Federal and State Income Tax Calculator Program," economics department working paper, Williams College, April 2006, www.williams.edu/Economics/papers/bakijaDocumentation_IncTaxCalc.pdf.

Carroll, Robert, "Do Taxpayers Really Respond to Changes in Tax Rates? Evidence from the 1993 Act," Office of Tax Analysis Working Paper 78, U.S. Department of Treasury 1998.

Congressional Budget Office, *An Analysis of the President's Budgetary: Proposals for Fiscal Year 2008*, Congressional Budget Office, Washington, D.C., March 2007.

Congressional Budget Office, *Effective Federal Tax Rates, 1979-1997*, Congressional Budget Office, Washington, D.C., October 2001.

Giertz, Seth, "A Sensitivity Analysis of the Elasticity of Taxable Income," Working Paper 2008-01, Congressional Budget Office, Washington D.C., www.cbo.gov/ftpdocs/89xx/doc8936/2008-01.pdf, (January 2008).

——, "The Elasticity of Taxable Income over the 1980s and 1990s," *National Tax Journal*, 60(4), December 2007: 743-768.

[22] See Piketty and Saez (2007) and Saez and Veall (2005).

——, “The Elasticity of Taxable Income During the 1990s: A Sensitivity Analysis,” Congressional Budget Office, Washington D.C., Working Paper 2006-3, February 2006, www.cbo.gov/doc.cfm?index=7037.

Goolsbee, Austan, “What Happens When You Tax the Rich? Evidence from Executive Compensation,” *Journal of Political Economy* 2000, 108 (2), 352-378.

Gruber, Jonathan and Emmanuel Saez, “The Elasticity of Taxable Income: Evidence and Implications,” *Journal of Public Economics*, April 2002, 84 (1), 1–32.

Heim, Bradley, “The Elasticity of Taxable Income: Evidence from a New Panel of Tax Returns,” working paper 2007.

Internal Revenue Service, “Individual Income Tax Returns with Positive Adjusted Gross Income (AGI)” Unpublished Statistics of Income data, September 2004, www.irs.gov/pub/irs-soi/02in01ts.xls.

Kopczuk, Wojciech, “Tax Bases, Tax Rates and the Elasticity of Reported Income,” *Journal of Public Economics*, December 2005, 89 (11-12), 2093-2119.

Moffitt, Robert and Mark Wilhelm, “Taxation and the Labor Supply Decisions of the Affluent,” *Does Atlas Shrug? The Economic Consequences of Taxing the Rich*, Joel Slemrod, ed., New York: Harvard University Press and Russell Sage Foundation 2000.

Navratil, John, “The Tax Reform Act of 1986: New Evidence on Individual Taxpayer Behavior from Panel Tax Return Data,” In *Essays on the Impact of Marginal Tax Rate Reductions on the Reporting of Taxable Income on Individual Tax Returns*, Doctoral Dissertation (Chapter 3), Harvard University 1995.

Piketty, Thomas and Emmanuel Saez, “Income Inequality in the United States, 1913–1998,” *Quarterly Journal of Economics*, February 2003, 118 (1), 1–39.

— , “How Progressive is the U.S. Federal Tax System? A Historical and International Perspective,” *Journal of Economic Perspectives*, Winter 2007, 21(1), 3-24.

Saez, Emmanuel, “Reported Incomes and Marginal Tax Rates, 1960–2000: Evidence and Policy Implications,” *Tax Policy and the Economy 18*, In Poterba, J. (Ed.) 2004, Cambridge: MIT Press, 117-173.

Saez, Emmanuel and Michael Veall, “The Evolution of High Incomes in Northern America: Lessons from Canadian Evidence,” *American Economic Review* 95(3) 2005, 831-849.

Sammartino, Frank and David Weiner, “Recent Evidence on Taxpayers' Response to the Rate Increases in the 1990s,” *National Tax Journal*, September 1997, 50 (3), 683-705.

Slemrod, Joel and Wojciech Kopczuk, “The Optimal Elasticity of Taxable Income,” *Journal of Public Economics*, April 2002, 84 (1), 91–112.

Table 1. Summary Statistics

	Year-to-Year	3-year Intervals	End Years
Paired Observations[a]	99,421	157,083	31,142
Differencing: Years between Base and Subsequent Observations	1	3	6
Returns with Base Year Taxable Income Greater than:			
\$1,000,000	7,006	26,128	6,013
\$5,000,000	1,822	5,775	1,456
Mean Taxable Income[b]	\$36,566	\$34,877	\$41,360
Mean Gross Income[b]	\$51,827	\$55,749	\$60,047
Mean Federal Tax Rate	24.1	23.6	24.6
Mean State Tax Rate	4.8	4.4	4.5
Mean Net-of-Tax Rate	71.1	72.0	70.9

Source: Calculations based on Statistics of Income data from 1989 to 1995.
a. Sample sizes are based on \$30,000 income cutoff, but do not include the full set of restrictions used for the regression analysis. The year-to-year sample excludes filers who are not observed every year.
b. Incomes are expressed in 1992 dollars, adjusted by the growth in gross income.

Table 2. Alternative Sets of Control Variables

A	The log of base-year income	$\ln(income_t)$
B	The log of income in the year before the base year and the difference in logs between base-year income and that of the year prior	$\ln(income_{t-1})$ and $\ln\left(\frac{income_t}{income_{t-1}}\right)$
C	A 10-piece spline of the log of base-year income	10 - piece spline of $\ln(income_t)$
D	A 10-piece spline of the log of income in the year before the base year and the difference in logs between base-year income and that of the year prior	10 - piece spline of $\ln(income_{t-1})$ and $\ln\left(\frac{income_t}{income_{t-1}}\right)$
E	The log of income in the year before the base year and a 10-piece spline of the difference in logs between base-year income and that of the year prior	10 - piece spline of $\ln\left(\frac{income_t}{income_{t-1}}\right)$ and $\ln(income_{t-1})$
F	A 10-piece spline of the log of income in the year before the base year and a 10-piece spline of the difference in logs between base-year income and that of the year prior	10 - piece splines of both $\ln(income_{t-1})$ and $\ln\left(\frac{income_t}{income_{t-1}}\right)$

Table 3. Income-Weighted ETI Estimates without Adjacent-Year MTRs: 1989-95

	Income Cutoff	none	*A*	*B*	*C*	*D*	*E*	*F*
	year-to-year							
Panel 1	$10k	-0.014	-0.342	-0.026	-0.141	0.007	-0.023	0.000
		(0.079)	(0.081)	(0.073)	(0.076)	(0.075)	(0.074)	(0.075)
	$30k	0.114	-0.241	0.127	-0.106	0.152	0.130	0.145
		(0.067)	(0.065)	(0.073)	(0.061)	(0.075)	(0.073)	(0.075)
	$50k	0.204	-0.255	0.186	-0.177	0.194	0.188	0.188
		(0.081)	(0.076)	(0.089)	(0.075)	(0.091)	(0.089)	(0.091)
	3-year intervals							
Panel 2	$10k	1.409	-0.025	-0.015	0.3	0.36	-0.052	0.314
		(0.130)	(0.097)	(0.103)	(0.131)	(0.125)	(0.102)	(0.123)
	$30k	1.506	0.136	0.13	0.415	0.377	0.079	0.319
		(0.138)	(0.113)	(0.119)	(0.153)	(0.137)	(0.117)	(0.136)
	$50k	1.574	0.206	0.22	0.543	0.344	0.196	0.328
		(0.144)	(0.152)	(0.159)	(0.182)	(0.165)	(0.154)	(0.163)
	end years 1989 to 1995							
Panel 3	$10k	1.803	-0.059	-0.063	0.424	0.451	-0.037	0.436
		(0.278)	(0.167)	(0.177)	(0.264)	(0.255)	(0.179)	(0.253)
	$30k	1.818	0.147	0.143	0.468	0.491	0.143	0.474
		(0.292)	(0.191)	(0.202)	(0.306)	(0.261)	(0.203)	(0.258)
	$50k	1.783	0.2	0.172	0.474	0.342	0.164	0.342
		(0.292)	(0.266)	(0.261)	(0.340)	(0.289)	(0.259)	(0.288)
	end years 1985 to 1989							
Panel 4	$10k	-0.166	0.992	0.34	0.966	0.406	0.885	0.387
		(0.093)	(0.153)	(0.180)	(0.162)	(0.166)	(0.164)	(0.165)
	$30k	-0.032	0.775	0.35	0.777	0.422	0.763	0.431
		(0.100)	(0.170)	(0.190)	(0.177)	(0.177)	(0.178)	(0.173)
	$50k	-0.029	0.63	0.376	0.69	0.684	0.734	0.665
		(0.115)	(0.223)	(0.235)	(0.211)	(0.231)	(0.210)	(0.219)

Source: Estimates are based on Statistics of Income data for years 1989 to 1995.
Estimates are from 2SLS regressions. Regressions are weighted by the inverse of sampling probabilities and by income (see Section III). Robust standard errors, clustered by tax filer, are in parentheses.

Table 4. Income-Weighted ETI Estimates with Adjacent-Year MTRs: 1989-95

	Income Cutoff		none	*A*	*B*	*C*	*D*	*E*	*F*
		year-to-year							
Panel 1	\$10k		0.367	-0.222	0.200	-0.109	0.314	0.200	0.299
			(0.079)	(0.109)	(0.087)	(0.122)	(0.095)	(0.087)	(0.094)
	\$30k		0.570	-0.059	0.342	0.030	0.433	0.342	0.418
			(0.077)	(0.094)	(0.087)	(0.099)	(0.094)	(0.087)	(0.094)
	\$50k		0.668	-0.081	0.378	-0.036	0.436	0.378	0.425
			(0.090)	(0.108)	(0.105)	(0.111)	(0.112)	(0.105)	(0.112)
		3-year intervals							
Panel 2	\$10k		1.867	0.466	0.466	1.221	1.422	0.410	1.371
			(0.141)	(0.189)	(0.184)	(0.249)	(0.255)	(0.188)	(0.249)
	\$30k		1.891	0.777	0.707	1.315	1.352	0.633	1.286
			(0.146)	(0.243)	(0.227)	(0.277)	(0.278)	(0.226)	(0.270)
	\$50k		1.783	0.737	0.728	1.106	0.993	0.682	0.975
			(0.151)	(0.357)	(0.320)	(0.312)	(0.317)	(0.313)	(0.304)

Source: Estimates are based on Statistics of Income data for years 1989 to 1995.
Estimates are from 2SLS regressions. Regressions are weighted by the inverse of sampling probabilities and by income (see Section III). Robust standard errors, clustered by tax filer, are in parentheses.

Table 5. Income-Weighted Gross Income Elasticity Estimates without Adjacent-Year MTRs: 1989-95

	Income Cutoff	none	*A*	*B*	*C*	*D*	*E*	*F*
		year-to-year						
Panel 1	$10k	-0.011	-0.166	-0.071	-0.102	-0.019	-0.079	-0.022
		(0.058)	(0.058)	(0.059)	(0.057)	(0.060)	(0.059)	(0.060)
	$30k	0.013	-0.134	0.034	-0.107	0.062	0.026	0.056
		(0.044)	(0.044)	(0.056)	(0.043)	(0.057)	(0.056)	(0.057)
	$50k	0.067	-0.146	0.055	-0.127	0.073	0.044	0.063
		(0.053)	(0.056)	(0.070)	(0.057)	(0.071)	(0.070)	(0.071)
		3-year intervals						
Panel 2	$10k	1.035	0.13	0.105	0.171	0.216	0.072	0.189
		(0.086)	(0.063)	(0.066)	(0.068)	(0.068)	(0.065)	(0.068)
	$30k	1.293	0.213	0.214	0.291	0.287	0.188	0.256
		(0.111)	(0.090)	(0.095)	(0.105)	(0.101)	(0.093)	(0.100)
	$50k	1.376	0.259	0.238	0.392	0.278	0.257	0.295
		(0.119)	(0.121)	(0.124)	(0.128)	(0.123)	(0.122)	(0.123)
		end years 1989 to 1995						
Panel 3	$10k	1.254	0.285	-0.001	0.171	0.142	-0.02	0.141
		(0.165)	(0.115)	(0.102)	(0.134)	(0.125)	(0.101)	(0.123)
	$30k	1.456	0.267	0.121	0.355	0.223	0.108	0.225
		(0.198)	(0.130)	(0.142)	(0.215)	(0.177)	(0.142)	(0.174)
	$50k	1.494	0.278	0.265	0.55	0.324	0.306	0.356
		(0.202)	(0.178)	(0.200)	(0.260)	(0.218)	(0.197)	(0.217)
		end years 1985 to 1989						
Panel 4	$10k	-0.119	0.253	0.063	0.419	0.257	0.434	0.257
		(0.069)	(0.111)	(0.155)	(0.155)	(0.148)	(0.155)	(0.147)
	$30k	0.01	0.179	0.082	0.382	0.288	0.39	0.279
		(0.082)	(0.165)	(0.171)	(0.175)	(0.171)	(0.174)	(0.167)
	$50k	0.045	0.086	0.13	0.443	0.398	0.437	0.384
		(0.104)	(0.281)	(0.227)	(0.227)	(0.237)	(0.224)	(0.229)

Source: Estimates are based on Statistics of Income data for years 1989 to 1995.
Estimates are from 2SLS regressions. Regressions are weighted by the inverse of sampling probabilities and by income (see Section III). Robust standard errors, clustered by tax filer, are in parentheses.

Table 6. Income-Weighted Gross Income Elasticity Estimates with Adjacent-Year MTRs: 1989-95

	Income Cutoff	none	*A*	*B*	*C*	*D*	*E*	*F*
		year-to-year						
Panel 1	\$10k	0.222	-0.204	0.048	-0.108	0.144	0.040	0.141
		(0.058)	(0.074)	(0.070)	(0.080)	(0.075)	(0.070)	(0.074)
	\$30k	0.326	-0.075	0.146	-0.035	0.201	0.135	0.193
		(0.058)	(0.071)	(0.068)	(0.074)	(0.072)	(0.067)	(0.071)
	\$50k	0.387	-0.102	0.151	-0.079	0.187	0.137	0.174
		(0.068)	(0.082)	(0.083)	(0.086)	(0.086)	(0.082)	(0.086)
		3-year intervals						
Panel 2	\$10k	1.741	0.453	0.869	1.765	1.478	0.822	1.433
		(0.138)	(0.176)	(0.126)	(0.277)	(0.162)	(0.126)	(0.157)
	\$30k	1.762	0.787	1.13	1.9	1.66	1.093	1.614
		(0.143)	(0.226)	(0.188)	(0.318)	(0.241)	(0.183)	(0.233)
	\$50k	1.656	0.813	1.193	1.836	1.481	1.217	1.515
		(0.148)	(0.334)	(0.262)	(0.371)	(0.291)	(0.253)	(0.281)

Source: Estimates are based on Statistics of Income data for years 1989 to 1995.
Estimates are from 2SLS regressions. Regressions are weighted by the inverse of sampling probabilities and by income (see Section III). Robust standard errors, clustered by tax filer, are in parentheses.

Table 7. Income-Weighted ETI Estimates without Adjacent-Year MTRs

Income-Weighted ETI Estimates: 1989 to 1995						
Interval Length	1-Year		3-Year		6-Year	
	E	F	E	F	E	F
$\ln((1 - mtr_{t+s})/(1 - mtr_t))$	0.682	0.975	0.196	0.328	0.164	0.342
	(0.313)	(0.304)	(0.154)	(0.163)	(0.259)	(0.288)
$\ln((1 - mtr_t)/(1 - mtr_{t-1}))$	-0.495	-0.703				
	(0.125)	(0.136)				
$\ln((1 - mtr_{t+2})/(1 - mtr_{t+1}))$	0.177	0.252				
	(0.107)	(0.098)				
$\ln(income_{t-1}))$	-0.033		-0.057		-0.146	
	(0.019)		(0.009)		(0.026)	
Single	-0.020	-0.014	-0.035	-0.033	0.091	0.103
	(0.045)	(0.042)	(0.040)	(0.038)	(0.109)	(0.109)
Joint Return	0.034	0.029	0.03	0.023	0.265	0.261
	(0.043)	(0.040)	(0.038)	(0.035)	(0.104)	(0.103)
Head of Household						
Age	0.122	0.120	0.093	0.095	0.203	0.195
	(0.012)	(0.013)	(0.011)	(0.011)	(0.037)	(0.037)
Age Squared/10	-0.026	-0.025	-0.02	-0.02	-0.043	-0.042
	(0.002)	(0.002)	(0.002)	(0.002)	(0.008)	(0.008)
Age Cubed/100	0.016	0.016	0.012	0.013	0.027	0.026
	(0.002)	(0.002)	(0.001)	(0.001)	(0.005)	(0.005)
Itemizer Dummy	-0.125	-0.111	-0.122	-0.116	-0.168	-0.164
	(0.015)	(0.015)	(0.013)	(0.013)	(0.028)	(0.029)
$\ln(income_{t-1})$*decile 1	-0.386	-0.410		-0.481		-0.53
	(0.063)	(0.068)		(0.151)		(0.225)
$\ln(income_{t-1})$*decile 2	-0.332	-0.270		-0.731		-0.599
	(0.111)	(0.112)		(0.211)		(0.244)
$\ln(income_{t-1})$*decile 3	-0.102	-0.018		-0.341		-0.652
	(0.158)	(0.161)		(0.192)		(0.188)
$\ln(income_{t-1})$*decile 4	0.034	0.108		-0.274		-0.171
	(0.250)	(0.256)		(0.095)		(0.193)
$\ln(income_{t-1})$*decile 5	-0.415	-0.334		-0.142		-0.271
	(0.278)	(0.284)		(0.047)		(0.122)
$\ln(income_{t-1})$*decile 6	0.277	0.199		0.044		-0.015
	(0.271)	(0.277)		(0.033)		(0.092)
$\ln(income_{t-1})$*decile 7	-0.817	-0.894		0.024		-0.087
	(0.208)	(0.210)		(0.030)		(0.066)
$\ln(income_{t-1})$*decile 8	-0.178	-0.316		-0.1		-0.098
	(0.159)	(0.162)		(0.035)		(0.077)
$\ln(income_{t-1})$*decile 9	-0.651	-0.604		-0.018		-0.034
	(0.108)	(0.117)		(0.047)		(0.094)
$\ln(income_{t-1})$*decile 10	-0.432	-0.648		-0.159		-0.245
	(0.083)	(0.109)		(0.033)		(0.072)
$\ln((income_t)/(income_{t-1}))$*decile 1		-0.490	-0.397	-0.407	-0.382	-0.356
		(0.176)	(0.050)	(0.052)	(0.148)	(0.158)
$\ln((income_t)/(income_{t-1}))$*decile 2		-0.743	-0.321	-0.269	-0.427	-0.336
		(0.237)	(0.099)	(0.100)	(0.201)	(0.203)
$\ln((income_t)/(income_{t-1}))$*decile 3		-0.363	-0.096	-0.04	-0.323	-0.236
		(0.217)	(0.150)	(0.153)	(0.394)	(0.403)
$\ln((income_t)/(income_{t-1}))$*decile 4		-0.460	-0.049	0.017	-0.268	-0.033
		(0.116)	(0.219)	(0.222)	(0.537)	(0.544)
$\ln((income_t)/(income_{t-1}))$*decile 5		-0.323	-0.345	-0.294	-0.205	-0.196

		(0.068)	(0.256)	(0.260)	(0.575)	(0.587)
$\ln((\text{income}_t)/(\text{income}_{t-1}))$*decile 6		0.302	0.352	0.315	-0.662	-0.625
		(0.082)	(0.241)	(0.245)	(0.460)	(0.469)
$\ln((\text{income}_t)/(\text{income}_{t-1}))$*decile 7		-0.010	-0.86	-0.918	0.305	0.345
		(0.030)	(0.182)	(0.185)	(0.326)	(0.330)
$\ln((\text{income}_t)/(\text{income}_{t-1}))$*decile 8		-0.007	-0.207	-0.293	-0.644	-0.609
		(0.042)	(0.136)	(0.140)	(0.242)	(0.262)
$\ln((\text{income}_t)/(\text{income}_{t-1}))$*decile 9		-0.096	-0.609	-0.584	-0.208	-0.339
		(0.045)	(0.102)	(0.117)	(0.117)	(0.161)
$\ln((\text{income}_t)/(\text{income}_{t-1}))$*decile 10		-0.135	-0.422	-0.607	-0.260	-0.577
		(0.037)	(0.064)	(0.094)	(0.081)	(0.232)
Constant	-1.480	3.385	-0.784	3.585	-1.568	2.299
	(0.332)	(1.635)	(0.241)	(1.389)	(0.650)	(2.122)
Observations	47,096	47,096	78,778	78,778	15,594	15,594
R-Squared	0.02	0.02	0.06	0.07	0.05	0.06

Source: Estimates based on Statistics of Income data for years 1988 to 1995.

Estimates are from 2SLS regressions. The income range is $50,000 and above. Regressions are weighted by the inverse of sampling probabilities and by income (see Section III). Robust standard errors, clustered by tax filer, are in parentheses.

Table 8. Income-Weighted ETI Estimates with Adjacent-Year MTRs

Income-Weighted ETI Estimates: 1989 to 1995				
Interval Length	1-Year		3-Year	
	E	F	E	F
$\ln((1 - mtr_{t+s})/(1 - mtr_t))$	0.378	0.425	0.682	0.975
	(0.105)	(0.112)	(0.313)	(0.304)
$\ln((1 - mtr_t)/(1 - mtr_{t-1}))$	0.621	0.683	-0.495	-0.703
	(0.086)	(0.094)	(0.125)	(0.136)
$\ln((1 - mtr_{t+2})/(1 - mtr_{t+1}))$	0.333	0.354	0.177	0.252
	(0.107)	(0.111)	(0.107)	(0.098)
$\ln(income_{t-1})$	-0.029		-0.033	
	(0.005)		(0.019)	
Single			-0.020	-0.014
			(0.045)	(0.042)
Joint Return	0.004	0.004	0.034	0.029
	(0.009)	(0.009)	(0.043)	(0.040)
Head of Household	-0.010	-0.014		
	(0.024)	(0.024)		
Age	0.016	0.018	0.122	0.120
	(0.009)	(0.009)	(0.012)	(0.013)
Age Squared/10	-0.003	-0.004	-0.026	-0.025
	(0.002)	(0.002)	(0.002)	(0.002)
Age Cubed/100	0.000	0.000	0.016	0.016
	(0.000)	(0.000)	(0.002)	(0.002)
Itemizer Dummy	0.020	0.021	-0.125	-0.111
	(0.009)	(0.009)	(0.015)	(0.015)
$\ln(income_{t-1})$*decile 1		-0.036	-0.386	-0.410
		(0.050)	(0.063)	(0.068)
$\ln(income_{t-1})$*decile 2		-0.022	-0.332	-0.270
		(0.048)	(0.111)	(0.112)
$\ln(income_{t-1})$*decile 3		-0.066	-0.102	-0.018
		(0.068)	(0.158)	(0.161)
$\ln(income_{t-1})$*decile 4		-0.086	0.034	0.108
		(0.085)	(0.250)	(0.256)
$\ln(income_{t-1})$*decile 5		0.038	-0.415	-0.334
		(0.079)	(0.278)	(0.284)
$\ln(income_{t-1})$*decile 6		-0.171	0.277	0.199
		(0.041)	(0.271)	(0.277)
$\ln(income_{t-1})$*decile 7		-0.042	-0.817	-0.894
		(0.022)	(0.208)	(0.210)
$\ln(income_{t-1})$*decile 8		-0.037	-0.178	-0.316
		(0.012)	(0.159)	(0.162)
$\ln(income_{t-1})$*decile 9		0.002	-0.651	-0.604
		(0.014)	(0.108)	(0.117)
$\ln(income_{t-1})$*decile 10		-0.029	-0.432	-0.648
		(0.015)	(0.083)	(0.109)
$\ln((income_t)/(income_{t-1}))$*decile 1	-0.148	-0.146		-0.490
	(0.043)	(0.042)		(0.176)
$\ln((income_t)/(income_{t-1}))$*decile 2	-0.192	-0.183		-0.743
	(0.068)	(0.068)		(0.237)
$\ln((income_t)/(income_{t-1}))$*decile 3	-0.123	-0.120		-0.363
	(0.082)	(0.083)		(0.217)
$\ln((income_t)/(income_{t-1}))$*decile 4	-0.182	-0.165		-0.460
	(0.092)	(0.093)		(0.116)
$\ln((income_t)/(income_{t-1}))$*decile 5	0.060	0.057		-0.323

	(0.087)	(0.088)		(0.068)
ln((income$_t$)/(income$_{t-1}$))*decile 6	-0.147	-0.157		0.302
	(0.065)	(0.065)		(0.082)
ln((income$_t$)/(income$_{t-1}$))*decile 7	-0.080	-0.084		-0.010
	(0.052)	(0.053)		(0.030)
ln((income$_t$)/(income$_{t-1}$))*decile 8	-0.106	-0.110		-0.007
	(0.043)	(0.044)		(0.042)
ln((income$_t$)/(income$_{t-1}$))*decile 9	-0.096	-0.105		-0.096
	(0.032)	(0.033)		(0.045)
ln((income$_t$)/(income$_{t-1}$))*decile 10	0.005	0.003		-0.135
	(0.017)	(0.019)		(0.037)
Constant	0.126	0.196	-1.480	3.385
	(0.163)	(0.444)	(0.332)	(1.635)
Observations	44,438	44,438	64,554	64,554
R-Squared	0.02	0.02	0.06	0.07

Source: Estimates based on Statistics of Income data for years 1988 to 1995.

Estimates are from 2SLS regressions. The income range is $50,000 and above. Regressions are weighted by the inverse of sampling probabilities and by income (see Section III). Robust standard errors, clustered by tax filer, are in parentheses.

Appendix Table A1. Person-Weighted ETI Estimates without Adjacent-Year MTRs: 1989-95

	Income Cutoff	none	*A*	*B*	*C*	*D*	*E*	*F*
		year-to-year						
Panel 1	$10k	0.069	-2.904	-0.982	-0.696	0.113	-0.602	0.065
		(0.380)	(0.320)	(0.314)	(0.433)	(0.516)	(0.319)	(0.497)
	$30k	0.034	-2.751	-0.843	-1.148	-0.223	-0.543	-0.217
		(0.331)	(0.277)	(0.271)	(0.349)	(0.410)	(0.282)	(0.407)
	$50k	0.403	-2.085	-0.285	-1.02	0.234	-0.141	0.162
		(0.223)	(0.264)	(0.206)	(0.231)	(0.279)	(0.210)	(0.273)
		3-year intervals						
Panel 2	$10k	0.251	-0.555	-0.46	-0.292	-0.247	-0.309	-0.198
		(0.109)	(0.098)	(0.100)	(0.102)	(0.105)	(0.098)	(0.104)
	$30k	0.377	-0.262	-0.229	0.012	0.031	-0.172	-0.01
		(0.120)	(0.106)	(0.110)	(0.135)	(0.129)	(0.111)	(0.128)
	$50k	0.756	-0.15	-0.045	0.181	0.092	-0.003	0.067
		(0.127)	(0.116)	(0.124)	(0.143)	(0.135)	(0.125)	(0.134)
	end years	1989 to 1995						
Panel 3	$10k	1.408	-0.565	-0.857	-0.084	-0.488	-0.634	-0.408
		(0.390)	(0.154)	(0.171)	(0.178)	(0.197)	(0.185)	(0.213)
	$30k	0.889	-0.241	-0.291	0.084	0.062	-0.146	0.029
		(0.260)	(0.212)	(0.245)	(0.293)	(0.302)	(0.248)	(0.301)
	$50k	0.953	-0.382	-0.344	-0.024	-0.154	-0.138	-0.112
		(0.245)	(0.240)	(0.284)	(0.275)	(0.306)	(0.282)	(0.300)
	end years	1985 to 1989						
Panel 4	$10k	-2.099	1.328	0.318	1.131	0.572	0.753	0.297
		(0.109)	(0.155)	(0.165)	(0.180)	(0.189)	(0.166)	(0.175)
	$30k	-0.34	0.747	0.178	0.728	0.262	0.667	0.314
		(0.086)	(0.141)	(0.148)	(0.164)	(0.164)	(0.160)	(0.165)
	$50k	-0.156	0.822	0.169	0.879	0.717	0.792	0.633
		(0.091)	(0.181)	(0.162)	(0.211)	(0.204)	(0.198)	(0.194)

Source: Estimates based on Statistics of Income data for years 1989 to 1995.
Estimates are from 2SLS regressions. Regressions are weighted by the inverse of sampling probabilities and by income (see Section III). Robust standard errors, clustered by tax filer, are in parentheses.

Appendix Table A2. Person-Weighted ETI Estimates with Adjacent-Year MTRs: 1989-95

	Income Cutoff	none	*A*	*B*	*C*	*D*	*E*	*F*
		year-to-year						
Panel 1	$10k	0.375	-0.118	0.182	0.201	0.309	0.214	0.297
		(0.105)	(0.107)	(0.102)	(0.102)	(0.105)	(0.098)	(0.102)
	$30k	0.458	-0.024	0.255	0.173	0.350	0.278	0.339
		(0.087)	(0.090)	(0.087)	(0.085)	(0.091)	(0.085)	(0.089)
	$50k	0.477	-0.066	0.254	0.026	0.332	0.290	0.329
		(0.096)	(0.104)	(0.094)	(0.102)	(0.098)	(0.093)	(0.097)
		3-year intervals						
Panel 2	$10k	0.763	-0.646	-0.319	0.234	0.279	0.023	0.468
		(0.183)	(0.166)	(0.171)	(0.180)	(0.204)	(0.172)	(0.205)
	$30k	1.463	0.264	0.292	1.004	0.955	0.405	0.937
		(0.190)	(0.194)	(0.195)	(0.246)	(0.267)	(0.199)	(0.265)
	$50k	1.406	0.337	0.453	0.825	0.738	0.522	0.705
		(0.169)	(0.269)	(0.266)	(0.251)	(0.281)	(0.274)	(0.279)
	end years	1989 to 1995						
Panel 3	$10k	1.408	-0.565	-0.857	-0.084	-0.488	-0.634	-0.408
		(0.390)	(0.154)	(0.171)	(0.178)	(0.197)	(0.185)	(0.213)
	$30k	0.889	-0.241	-0.291	0.084	0.062	-0.146	0.029
		(0.260)	(0.212)	(0.245)	(0.293)	(0.302)	(0.248)	(0.301)
	$50k	0.953	-0.382	-0.344	-0.024	-0.154	-0.138	-0.112
		(0.245)	(0.240)	(0.284)	(0.275)	(0.306)	(0.282)	(0.300)
	end years	1985 to 1989						
Panel 4	$10k	-2.099	1.328	0.318	1.131	0.572	0.753	0.297
		(0.109)	(0.155)	(0.165)	(0.180)	(0.189)	(0.166)	(0.175)
	$30k	-0.34	0.747	0.178	0.728	0.262	0.667	0.314
		(0.086)	(0.141)	(0.148)	(0.164)	(0.164)	(0.160)	(0.165)
	$50k	-0.156	0.822	0.169	0.879	0.717	0.792	0.633
		(0.091)	(0.181)	(0.162)	(0.211)	(0.204)	(0.198)	(0.194)

Source: Estimates are based on Statistics of Income data for years 1989 to 1995.
Estimates are from 2SLS regressions. Regressions are weighted by the inverse of sampling probabilities and by income (see Section III). Robust standard errors, clustered by tax filer, are in parentheses.